UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

PINE MIDGE - Retinodiplosis SP.

also contains

Rhyacionia SP. pine tip moth

Dioryctria ponderosae - pitch moth

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MEMORANDUM FOR INSTITUTE OF FOREST GENETICS:

Subject: Inspection of Insect Conditions at the Institute of Forest Genetics, Placerville, California

This memorandum is written as the result of a one-day inspection of insect conditions at the Placerville Institute of Forest Genetics. Notation is made of the insect species found to be present, and for those species of economic importance, notes on life cycle and habits are given in addition to certain suggested control measures.

Insects which have been causing injury of some significance include:

Rhyacionia sp. - a pine tip moth
Dioryctria ponderosae - the pitch moth
Retinodiplosis sp. - a pine resin midge

Species present, but of no apparent importance include:

Schizolachnus sp. - a needle-feeding aphid
Scythropus californicus - a weevil causing saw-tooth edge of needles
Angeris (Parharmonia) sp. - a pine pitch mass borer
- a lepidopterous needle tier

None of the three insects causing some significant damage can be said to be heavily infesting the plantings. In view of the values involved in such a study as forest genetics any insect damage is greatly magnified. In order to secure an accurate conception of the growth qualities, etc. of various species of trees it is important that insect damage be kept to a minimum. Experiments are being conducted with small groups of trees, and if the growth of an individual tree is interfered with, the interpretation of results is made more difficult and less accurate.

LIFE HISTORY AND HABIT NOTES

Tip Moth:

The tip moths comprise numerous species in the genus Rhyacionia which are pests of pine tips. Some of the species occurring in California have probably not been determined. Damage is caused by the feeding of the larvae which bore in the growing tips of the host tree, either killing the tip or injuring it so that a distorted growth results. Where a heavy infestation exists the trees become dwarfed and stunted, developing a bushy character. The tip moths overwinter in the pupal stage, probably for the most part within the larval burrows. In the spring the pupae transform to adults and eggs are laid on the needles and buds of the growing tips. In the region of Placerville it is believed that spring activity does not start until the month of May. As the young larvae bore into the tips, a

resinous exudation accumulates at the point of entrance which is frequently webbed over by the larvae. As the season advances, the work of the tip moth becomes more conspicuous. It is believed that the species occurring at Placerville has but one generation a year.

Pitch Moth:

The pitch moth is another lepidopterous pest of pine twigs, and like the tip moths also occurs throughout a wide range. The pitch moths differ from the tip moths, in that they extend their feeding activities down the twig for a considerable distance from the tip. They mine the cambium in irregular galleries causing the infested twig to die. Feeding activity also takes place in the buds, but can be distinguished from the feeding of the tip moths. The former eat the entire inside of the bud, leaving only the outer shell of scales, whereas the latter feed in the center of the buds and do not mine them as completely. Also the pitch moths do not have a characteristic pitch and web mass at the point of entrance, as is found where the tip moth has entered a bud. The pitch moth overwinters in the pupal stage, too, generally in the litter under the tree, but occasionally within a cocoon on the bole of the tree. Activity in the spring begins at about the same period as in the case of the shoot moth, when the adults appear and lay their eggs, and the young larvae commence their feeding. Definite life histories have not been worked out as yet for the species of tip moth and pitch moth at Placerville. The above statements are based on available information, but may contain some inaccuracies.

Pine Resin Midge:

The resin midge is a dipterous insect of the family Cecidomyidae, the larval feeding of which is the cause of the bird's eye effect seen in pine lumbers. This effect is created when wood layers overgrow pitch pockets formed by the midge larvae. In heavy infestations, however, severe distortion of growth and even death of the affected twigs may result. The various stages of the insect and its life cycle and work are shown in the accompanying plate. Eggs are laid on the buds and the larvae on hatching apparently first mine the needle bases, evidenced by groups of dead needles, then form pitch pockets in the cambial region from which pitch exudations indicate the activity of the insect. At the present time many of the larvae have emerged from the pockets in which they overwinter and are pupating on the needles. Between 20 and 25 percent of the pupae have already emerged. As will be noted in the chart, there is a considerable spread of all stages of the insect, so that at the present time everything from old larvae to new larvae may be found.

INFESTATION CONDITIONS

Tip moths and pitch moths are primarily pests of young trees, whereas the pitch midge may attack trees of any size. All of the trees at

the Institute of Forest Genetics are of susceptible size with respect to all three of these insects. Infestations of all three species is scattered thruout the plantings, being for the most part confined to ponderosa pine. An occasional injury on Monterey pine was noted, however, at the time of the examination, April 14, 1936, tip moth and pitch moth broods had not become active. It was apparent that tip moth population has been reduced nearly to a minimum through removal of infested tips, since no pupae were found. There always exists the factor of a renewed infestation from surrounding natural pine stands. It is difficult to state just how far an infestation can spread, since physiographic factors and climatic factors play a large part. Removal or cleaning up of nearby stands as a sanitary measure would be justified. The above statements are likewise applicable to the pitch moth situation. Evidence indicates that the pitch moth is more prevalent at the Institute than tip moth at present. The active season for both of these species does not begin until May, so it is accordingly difficult to predict the infestation conditions for the coming season.

Resin midge infestation at the present time is most severe in the upper half of a block of some 1200 ponderosa pine trees, representing stock from seed gathered in numerous localities throughout the West. This insect is apparently on the increase, and no doubt drifts in from surrounding infestations in native pines.

CONTROL

Unfortunately, no control experiments against the resin midge have been reported. The practicability of applying sprays against tip moths has been demonstrated and should be equally applicable against pitch moths. Because of the nature of the plantings at the Institute of Forest Genetics, a study should be made on the control of these insects. Were funds and personnel available such a step would be justified. Under existing conditions the control suggestions made herein must be conducted as of an experimental nature and must be regarded as such.

The following spray program is suggested:

Formula:

Lead arsenate	3 lbs.
Nicotine sulfate (.5% by volume)	2 qts.
Penetrol (.5% by volume)	2 quarts
Water	100 gallons

Time of Application:

At least 3 applications at 10-day intervals, starting as soon as equipment can be secured. Depending on the duration of emergence of the

midge, and the time of emergence of tip and pitch moths not yet begun, an additional application may be necessary. A close check should be kept on the activity of all three species.

Equipment and Method of Application:

Several types of equipment may be used. If a power spraying outfit with sufficient length of hose can be secured, the time element can be kept to a minimum. If a truck can be moved about all sides of the ponderosa block, such a method will be most feasible. In event a power sprayer cannot be secured, resort can be made either to barrel pumps, which can be wheeled through the plantations, or to back pumps.

It is essential that complete coverage be secured in spraying. Conifers present a difficulty in spraying, since the needles tend to shield the branch when hit by a spray stream. A fairly fine spray should be secured from the nozzle, and it should be directed downward where possible on the smaller trees. As the following season proceeds and needles unfold from the new shoots it becomes easier to secure better coverage. Since control in this case is not particularly tied to economic considerations, it will be better to apply an excess of spray in order to make as efficient an application as possible - as much as 2 gallons on trees 4 to 6 feet in height may be applied.

Areas to be Sprayed:

Ponderosa pine block of 7 year old trees
Ponderosa pine in arboretum

Other species in arboretum if attack by any of 3 insects under consideration appears.

Block between nursery beds and new building, if injury is evident. Since it will probably be impossible to spray all the trees on the grounds, it is the first 2 mentioned units which must be given primary consideration.

It would be advisable to make a small sample spraying before going ahead with a large program so as to determine if any spray injury will result. It is not believed that the formula given will cause any burning. However, atmospheric conditions play an important part in spray effects. Applications should be made on a dry day, during the morning hours.

A general clean-up program to involve as much surrounding natural reproduction as possible would be advisable as a sanitation measure. Most feasible would be the destruction of such areas by cutting and burning. Whereas a hand-picking control method could be used against tip moth and pitch moth, and possibly also the clipping of midge-infested branches, would destroy a part of the population of any one year, such measures would have little effect on the spread at time of flight and would of necessity have to be repeated each year.

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Berkeley, California
April 17, 1936

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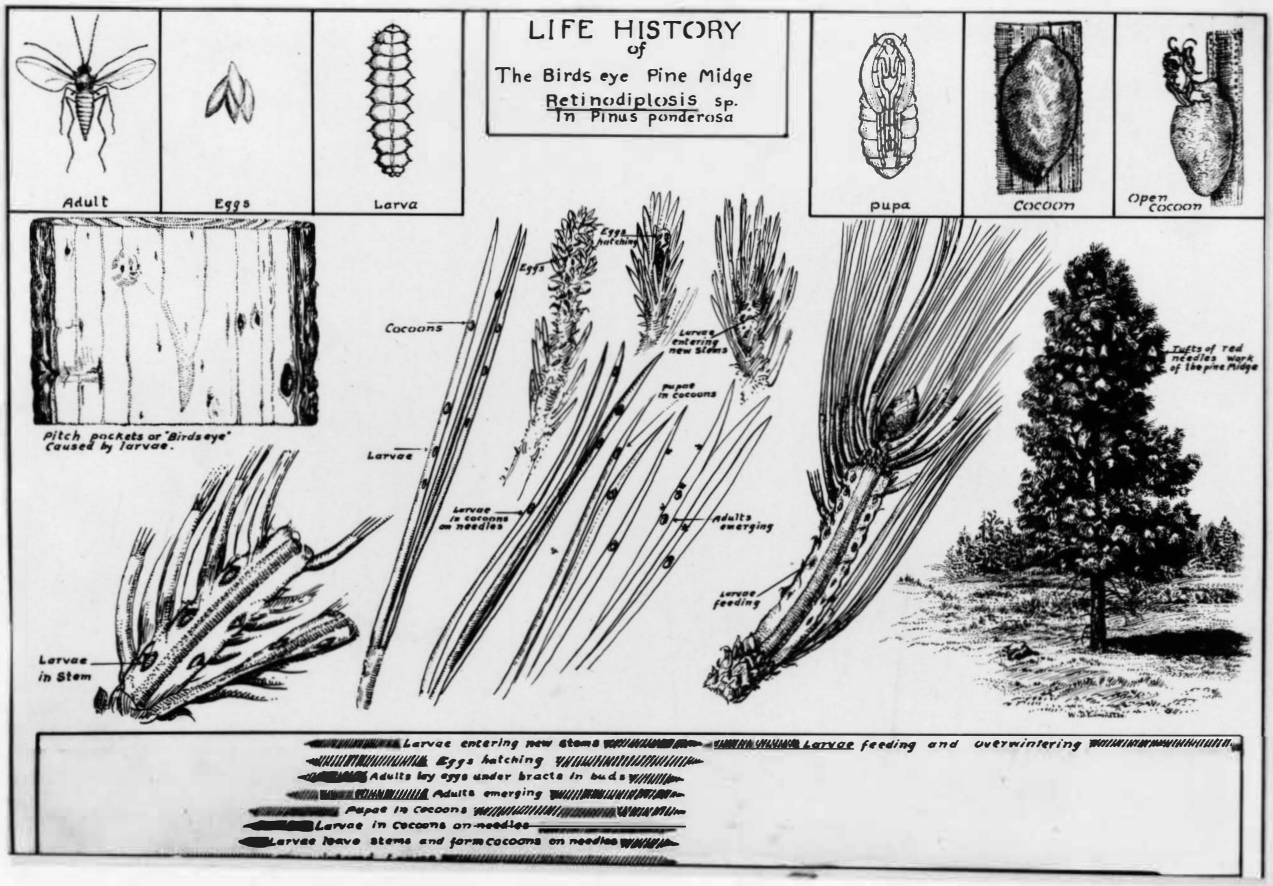
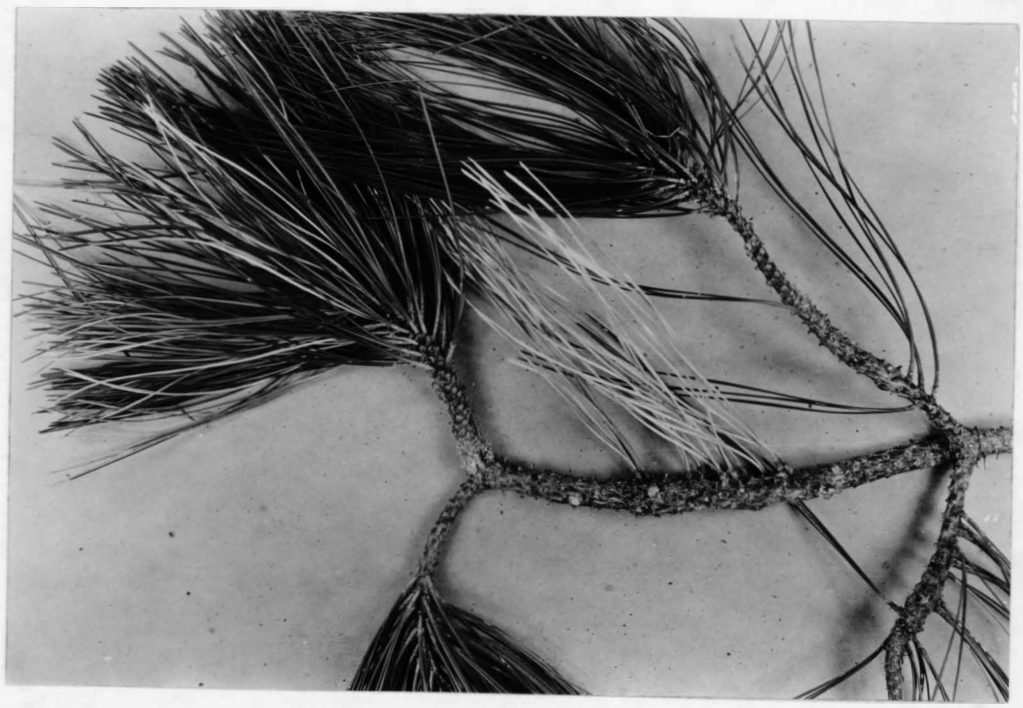
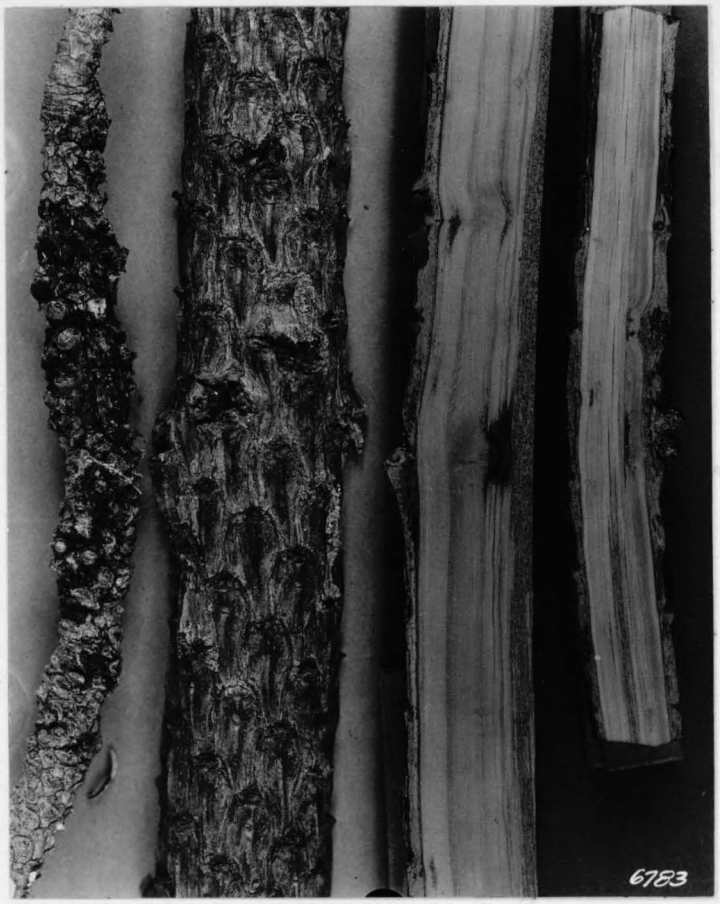
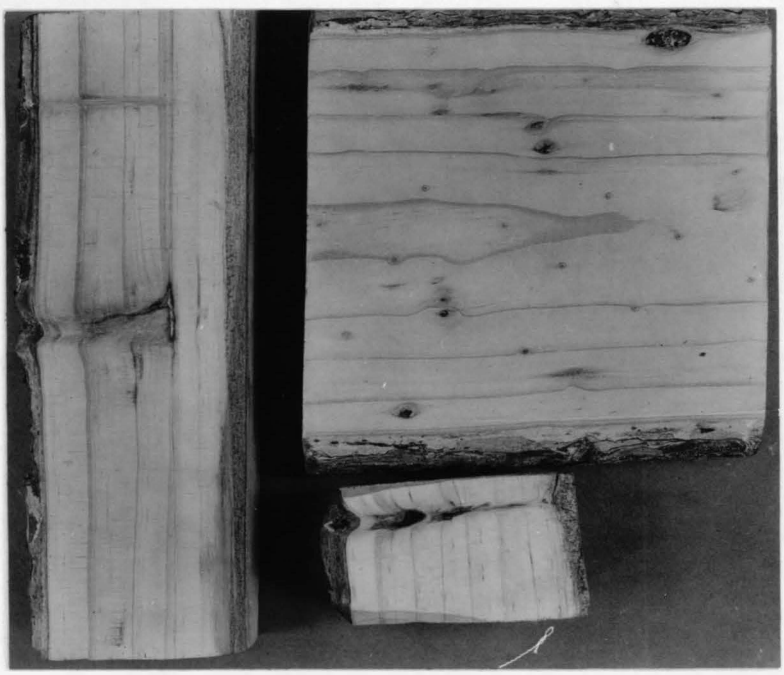

LIFE HISTORY
of
The Birds eye Pine Midge
Retinodiplosis sp.
In Pinus ponderosa
Adult
Eggs
Larva
pupa
Cocoon
Open Cocoon
Pitch packets or "Birds eye" Caused by larvae.
Eggs
Eggs hatching
Cocoons
Larvae entering new Stems
Pupae in Cocoons
Larvae
Larvae in cocoons on needles
Adults emerging
Larvae feeding
Larvae in Stem
Tufts of red needles work of the pine Midge
Larvae entering new stems
Larvae feeding and overwintering
Eggs hatching
Adults lay eggs under bracts in buds
Adults emerging
Pupae in Cocoons
Larvae in Cocoons on needles
Larvae leave stems and form cocoons on needles







BIRD'S EYE PINE MIDGE

Upper photo. - At left is a lateral slow-growing twig showing swellings and abortive growth due to resin pits of pine midge. Next to this is a leader of a fast-growing tree with conspicuous swellings caused by pits.

The sectioned twigs have been opened to show how the resin pits become incorporated in wood growth of the stem.

Lower photo - left. - Ponderosa pine twig split open to show resin pits in phloem with larvae in position.

Lower photo - right. - Typical samples of the "bird's eye" in wood of ponderosa pine.